Space Weather Technical Forecast

Issued on Friday, 11 August 2023 at 01:25 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity recorded at GOES16 has been Low over the past 24 hours, with occasional C-class flares observed. These flares peaked with a C7.6 at 10/2221 UTC from ex-AR3398, that is now behind the southwestern limb. Most remaining C-class flares where produced by AR3395.
There are now five numbered sunspot regions on the visible disc, and three yet to be numbered regions. Of the numbered regions AR3394 and AR3395 are the largest and most complex on the disc, Dho/beta-gamma and Dai/beta-gamma-delta respectively. AR3395 developed the delta spot through the period, as intermediate spots consolidated and rudimentary penumbra appeared. The remaining regions on the visible disc are small, simple and weak and have shown little change.

A large filament gradually released in the far south of the facing side of the disc around 10/0600UTC. The resultant CME has been analysed and is considered to miss Earth. Therefore at the time of writing no Earth-directed CMEs have been identified.

Solar Wind / Geomagnetic Activity: The solar wind, as measured at L1 by ACE and DSCOVR, was mostly at background levels until the evening. Then the solar wind increased to slightly elevated levels, and briefly reached elevated levels late evening, peaking at 514 km/s at 10/2159 UTC. The solar wind density started at below average values, but increased to average values through the evening. The IMF was mostly at weak levels, but after 10/1606 UTC a minor discontinuity occurred, with the IMF rising to briefly reach moderate levels, peaking at 10 nT at 10/1649 UTC. The IMF ended the period at weak levels again. The north-south component was predominantly weakly negative, but as the weak discontinuity occurred in the IMF so the Bz became positive and remained that way. The phi angle was predominantly negative (towards the Sun).
The net result of the above solar wind measures was for Quiet (Kp 1-2) geomagnetic conditions throughout.

Energetic Particles / Solar Radiation: GOES16 high energy (greater than 10MeV) proton flux showed the ongoing tail of a response to the X1.5 flare peaking at 07/2046UTC from Ex-AR3386 (now long-past the western limb). Having peaked at 47pfu early on 09 August, levels fell below the 10pfu boundary at 10/0955 UTC and have continued to decrease.
High energy (greater than 2MeV) electron flux at GOES16 started at background to moderate levels but increased above the High threshold between 10/1430-1745 UTC, peaking at 1.7e3 at 10/1700 UTC. The associated 24-hour integrated fluence remained well below the Active level (1e8 integrated pfu), with 1.77e7 integrated pfu recorded at 11/0001UTC with near-level trend.

Four-Day Space Weather Forecast Summary

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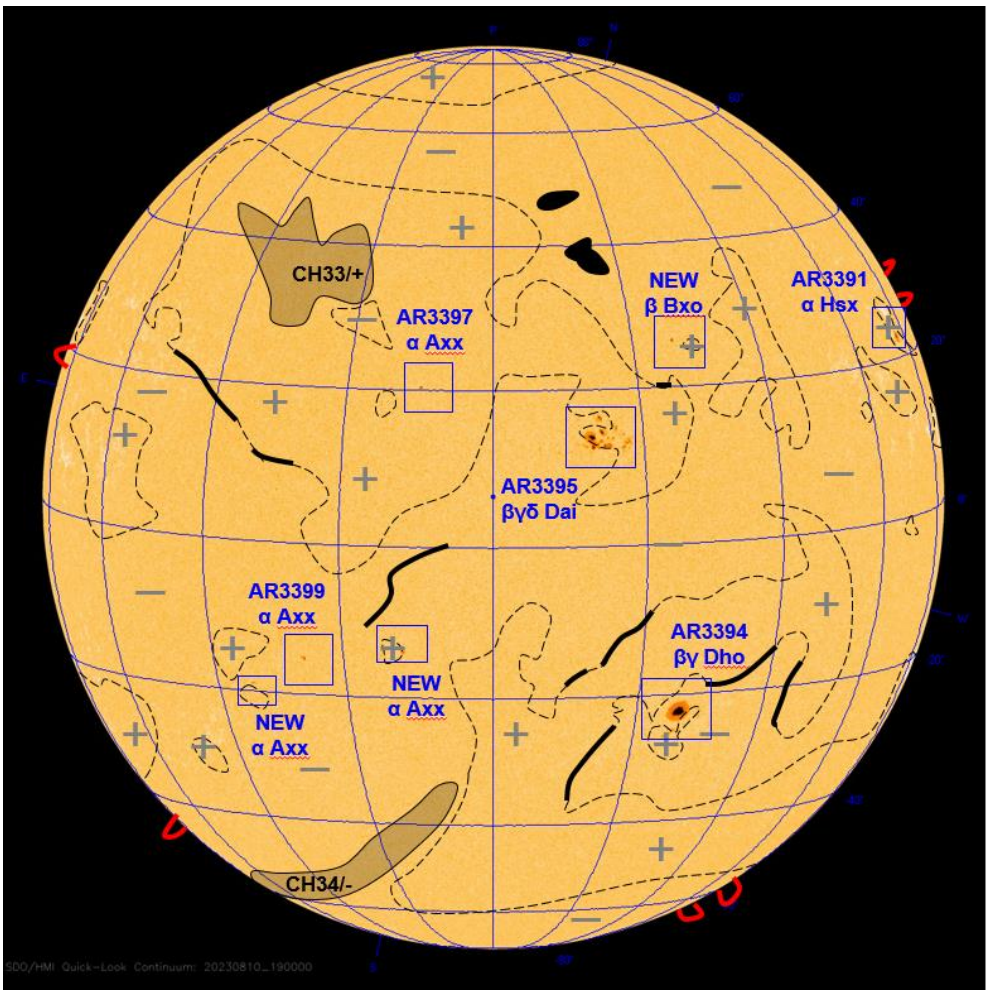
Solar Activity: Low levels of solar activity are anticipated, with only a Chance of M-class flares, this initially most likely from ex-AR3398 but then after today from AR3394 and AR3395 as ex-AR3398 rotates further behind the southwestern limb.

Solar Wind / Geomagnetic Activity: No significant coronal holes and so associated fast winds, nor Earth-bound CMEs, feature in the forecast. Therefore mainly Quiet (Kp 0-2) conditions should persist, with a chance of isolated Unsettled (Kp 3) periods.

Energetic Particles / Solar Radiation: The risk of further S1 Minor Solar Radiation Storms should continue to decrease, with ex-AR3398 continuing to rotate further away beyond the west limb, while AR3394 and AR3394 remain relatively stable with no significant flares produced so far.
The high energy (greater than 2 MeV) electron flux will start at moderate levels, and may briefly peak above the High threshold today (1000 pfu) at the peak of the diurnal cycle. Thereafter, with the lack of significant coronal holes in the forecast, a steady decline is expected with the flux reaching background levels by the end of the period. The corresponding fluence is therefore also expected to decline, remaining well below the Active threshold.

Figure 1. Solar Analysis Valid 10/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs feature in the four-day forecast, nor coronal hole fast winds, and the risk of geomagnetic storms is therefore held very low and constant throughout.

Geo-Magnetic Storm	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability (Exceedance)			(%)	(%)	(%)	(%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X-Ray Flares:

There are currently up to eight sunspot regions on the visible disc, with five of these regions numbered. AR3394 and AR3395 remain the largest and most complex groups. AR3394 is close to developing a small, weak delta spot in some of it's trailing spots, having developed some rudimentary penumbra, and is now classified as Dho/beta-gamma. In contrast AR3395 has in recent hours developed a delta spot, due to compaction of the intermediate spots and a slight increase in surrounding penumbra. The remaining spots on the disc are all small, weak and magnetically simple with little change.

Low levels of solar activity are anticipated, with only a Chance of M-class flares, this initially most likely from ex-AR3398 but then after today from AR3394 and AR3395 as ex-AR3398 rotates further behind the southwestern limb. New regions may emerge from the far side onto the east limb, but the flare risk will not be increased until they have arrived and been assessed.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	25	20	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: Recent SDO images of AR3395 (left intensitygram flattened and right magnetogram) show the delta spot.

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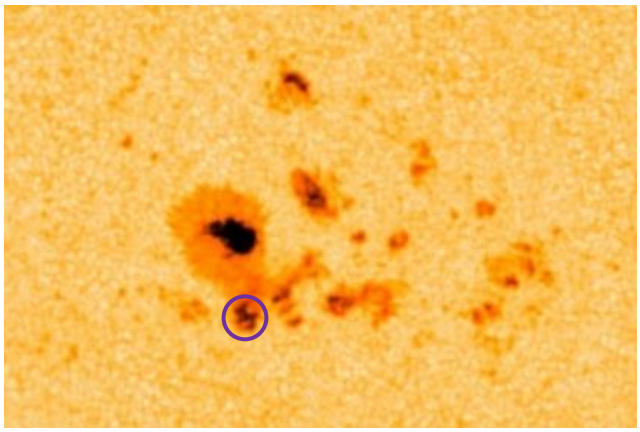

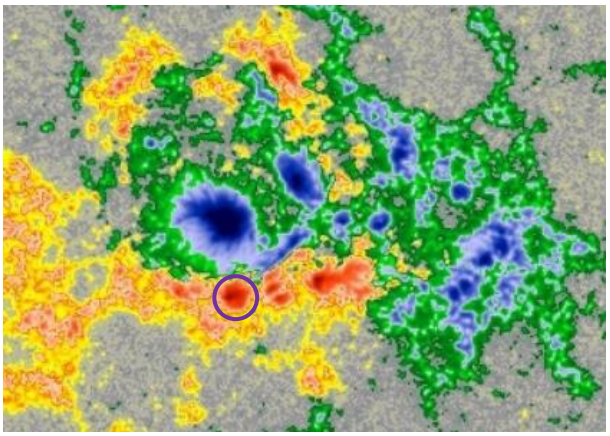

Solar Radiation Storms - (High Energy Protons):

Solar radiation levels have now finally ebbed below the S1 level for 10MeV protons. The sunspot group responsible for their initial enhancement is now long-past the western solar horizon (Ex-AR3386), as is its contributory trailing region (Ex-AR3387). Although declining, there remains a Slight Chance of further S1 events should large flares occur in either group. Meanwhile AR3394 and AR3394, the regions on the visible disc most likely to produce a significant flare have remained relatively stable.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	Yes	15	10	5	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux will start at moderate levels, and may briefly peak above the High threshold today (1000 pfu) at the peak of the diurnal cycle. Thereafter, with the lack of significant coronal holes in the forecast, a steady decline is expected with the flux reaching background levels by the end of the period. The corresponding fluence is therefore also expected to decline, remaining well below the Active threshold.
REFM's current forecast in maintaining fluence levels comfortably below Active is therefore accepted.

GEO Electron Environment	Level (cm^{-2} sr^{-1}	Past 24 Hours	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)

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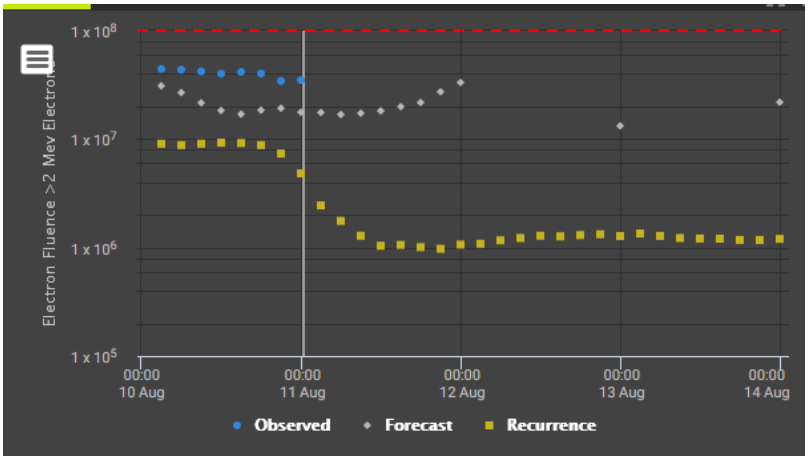
Probability (Exceedance)	day^{-1})	(Yes/No)	(%)	(%)	(%)	(%)
Active	**≥ 2 MeV ≥ 1x10^{8}**	No	1	10	10	10
Very Active	**≥ 2 MeV ≥ 1x10^{9}**	No	1	1	1	1

Figure 3: Met Office REFM model.



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